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POWER HAND TOOL RIGHT ANGLE ATTACHMENT HAVING
A LIGHT SOURCE WITH A SELF-GENERATING POWER SUPPLY

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1 POWER HAND TOOL RIGHT ANGLE ATTACHMENT HAVING
2 A LIGHT SOURCE WITH A SELF-GENERATING POWER SUPPLY

3 Background of the invention

4 The present invention generally relates to power hand tools and more particularly
5 to a right angle attachment for the same.

6 Small rotary hand tools that have a generally cylindrical housing or case have been
7 marketed for many years for use in carrying out various woodworking and metal working
8 tasks by hobbyists as well as commercial artisans. Such rotary hand tools generally have
9 a motor unit with a rotary output shaft extending from the nose end and often have a case
10 nose portion that is configured to connect to various accessories or attachments. Some of
11 these rotary hand tools are somewhat larger and more powerful and are known in the
12 building trade as spiral saws that use a side cutting bit to penetrate and to rapidly cut
13 holes for electrical outlets, light fixtures and switches and the like in dry wall. Because
14 these tools are quite powerful even though they are relatively small, they are convenient
15 to use on a jobsite or just about anywhere else where a source of AC power is available.

16 It is also desirable for some applications that the orientation of a grinding or
17 sawing tool be changed to a right angle relationship relative to the hand tool output shaft.
18 For such usage, a right angle attachment may be convenient for a sawing operation or for
19 working in hard to get at areas. In certain situations, a right angle relationship may
20 provide greater maneuverability that enables the hand tool to be handled and controlled
21 more easily.

22 Because such power hand tools can be used to perform many tasks, some of which
23 may be in locations where the ambient light is not particularly good, a recent
24 development has involved placement of lights at the nose end of the hand tool which are
25 illuminated by means of an onboard generating system typically in the form of a magnet
26 being located on the output shaft that creates a magnetic field that is induced into an

1 inductive coil or inductor which generates a current that is used to illuminate a light
2 producing device. While many types of light producing devices can be used, the solid-
3 state light emitting diodes (LEDs) are preferred because they are not prone to being easily
4 damaged and do emit sufficient amounts of light to illuminate the work area without
5 consuming any appreciable amount of power. It should be apparent that if the light
6 emitting diodes are in the nose portion of the hand tool, mounting an external attachment
7 to the nose portion of the tool likely covers the light being produced. Also, the
8 attachment extends the structure by a distance that may make the light produced
9 ineffective to illuminate the work area when a tool or blade is installed on the output shaft
10 of the accessory attachment.

11 Summary of the Invention

12 A preferred embodiment of the preferred invention comprises a right angle
13 attachment for a power hand tool of the type which has a generally cylindrical elongated
14 housing with a motor contained within the housing or case and the motor having an
15 output shaft that extends from the nose end of the hand tool. The attachment has a
16 housing with a mounting end that fits on the nose end portion of the tool housing, with
17 the housing having an input shaft and an output shaft that are operably coupled together
18 by bevel gears attached to each shaft. A magnet is mounted on the output shaft near an
19 electric circuit located within the housing for producing current that drives the LED's.
20 Since the magnet and the circuit are inside the housing, a lens is provided in the housing
21 adjacent the light producing device for emitting light to the exterior of the housing and
22 toward the tool attached to the distal end

23 Description of the Drawings

24 FIGURE 1A is a perspective side view of the preferred embodiment of the right
25 angle attachment

FIG. 1B is the nose portion of a power hand tool to which the right angle attachment of FIG 1A can be attached;

FIG. 2 is a front plan view of the apparatus of FIG. 1A;

FIG. 3 is a rear plan view of the apparatus of FIG. 1A;

FIG. 4 is a partial cut away of a left front perspective, particularly illustrating the output shaft and light producing structure of the embodiment shown in FIG. 1A;

FIG. 5 is a top view of the light producing structure shown in FIG. 4;

FIG. 6 is a side plan view of the light producing structure of FIG. 4; and

FIG. 7 is an electrical schematic diagram of the circuitry of the light producing structure.

Detailed Description of the Preferred Embodiment

The preferred embodiment of the right angle attachment of the present invention is illustrated in FIGS. 1A, and 2-7. The structure of the attachment, indicated generally at 10, is best shown in FIGS. 1A, 2 and 3 and includes a housing 12 that has a mounting end 14 and a distal end 16, with the mounting end 14 having a cylindrically shaped inside surface 18 that is configured to snugly fit on a rotary power hand tool, indicated generally at 20. More particularly, the mounting end 14 fits on a cylindrical nose portion 22 of the tool 20 and has an annular groove 24 near the outer end thereof. The hand tool 20 has a motor (not shown) which has an output shaft 26 that preferably has a hollow interior 28 and an outside threaded surface. While not shown, a chuck or drive nut is threaded onto the output shaft 26 so that a tool can be secured to the shaft or the drive nut if an attachment such as the attachment 10 is mounted on the tool 20. The attachment 10 preferably has an input shaft 30 with a noncircular recess such as the square recess 32 that is configured to engage a drive shaft (not shown) that would fit into the square recess 32 as well as a similar square recess on a drive nut or the like. Rotation of the motor output shaft 28 will then drive the input shaft 30 when the attachment 10 is mounted to the hand tool 20.

1 To secure the attachment 10 to the nose portion 22, a clamping mechanism that
2 comprises a band 34 that has a locking lever 36 attached to opposite end portions of the
3 band. A gap 38 is formed in the mounting end 14, preferably by molding the gap during
4 manufacture, with the gap 38 allowing limited radial movement so that the locking lever
5 36 and band 34 can bias the mounting portion 14 inwardly into firm contact with the
6 cylindrical nose portion 22 of the hand tool. The length of the band 34 is such that the
7 lever can be pressed downwardly in a locking position which will bias the mounting
8 portion halves together and firmly hold the attachment 10 to the tool 20. A pair of
9 annular flanges 40 are provided at the mounting end portion which are separated a
10 distance that is greater than the width of the band 34 to retain the band 34 whether it is
11 loose or in locked position.

12 The input shaft 30 is journaled in bearings (not shown) and has a bevel gear 44, a
13 portion of which is shown in FIG. 4 that engages a complementary bevel gear 46 that is
14 attached to an output shaft 48 that is journaled in upper and lower bearings 50, only the
15 lower one of which is shown in FIG. 4. The outer portion of the bearing is secured by an
16 internal rib structure that is formed with the end portion 16. The bottom portion of the
17 shaft 48 has an enlarged annular flange 52 that provides a support surface for a saw blade
18 54 (see FIGS. 1A and 2) and a smaller diameter end portion 56 which has internal threads
19 for receiving an enlarged end cap 58 that has a small diameter threaded central portion
20 that engages the internal threads of the end portion 56.

21 Referring to FIGS. 4-6, a light producing structure, indicated generally at 60, is
22 shown to be located within the housing 12 between the bushing 50 and the pinion gear
23 46. The light producing structure comprises a printed circuit board 62 on which a pair of
24 inductors 64 are mounted together with a pair of LED's 66. The inductors and LED's
25 are interconnected by conductive lines that are formed on the printed circuit board 62 to
26 produce the electrical circuit diagram shown in FIG. 7. The four components are
27 connected in parallel by lines 68 and 70 and significantly the diode 66 are inverted
28 relative to each other, i.e., the cathode of each is connected to the anode of the other and
29 vice versa. As is shown in FIG. 5, the LED's are located in close proximity to a lens 70

1 that is also illustrated in FIGS. 1A, 2, 4 and 6 which has a pair of deflectable prongs 72
2 which enable the lens to be snap fit into the housing 12. While two inductors and two
3 LED's are shown, only one of either of them may produce a sufficient amount of light.

4 The configuration of the LED's relative to the printed circuit board 62 is such that
5 the lens 70 is located at the distal end 16 of the housing and is at the left side thereof as
6 shown in FIGS. 1A and 2 and is slightly angularly positioned to direct light downwardly
7 toward the blade 54. The lens 70 is preferably molded from a transparent plastic
8 material. A magnet 74, which preferably has eight poles, but can have a fewer number of
9 poles is in the form of a ring and is located immediately adjacent the printed circuit board
10 62 and is attached to the shaft 48. The magnet preferably has a flat upper surface where
11 the magnetic poles are located so they are in close proximity to the inductors 66. The
12 magnet 74 is also preferably sized so that it can be press fit onto the shaft 48 and be held
13 firmly in place.

14 It should be understood that the light producing mechanism 60 can be separately
15 fabricated, since the entire circuit and its components are mounted to the printed circuit
16 board which has a circular outer periphery but which also includes a cut out portion 76
17 that has a semi-circular portion in the center that enables it to fit around the shaft 48 and a
18 width that is also slightly larger than the shaft 48 which enables the printed circuit board
19 to be slipped onto the shaft 48 and into cooperative slots in the housing to hold it in its
20 proper position.

21 While not a part of the present invention, the attachment 10 may include a saw
22 guard 80 which can be removed from the attachment when the blade 54 is removed. A
23 locking button 82 is also provided on the left side which can be depressed to engage slots
24 in the bevel gear 46 (not shown) for the purpose of holding the output shaft 48 in place so
25 that the end cap 58 can be tightened and loosened.

26 In the present application, a "right" angle is intended to have a broader meaning
27 than precisely 90°, and refers to orientations having the general appearance of a 90°
28 angle.

1 When the magnet 74 rotates in close proximity to the inductive coils or inductors
2 64, current is induced in them as the flux lines pass alternately through them. As the
3 magnet poles pass by the inductors 64, they generate a positive or negative current in the
4 inductor, depending on the pole which is in proximity to the particular inductor 64 in a
5 generally sinusoidal waveform. The two LEDs 64 are connected so that their polarities
6 are opposite, and since each LED 64 allows current to flow in only one direction, they
7 alternately switch on and off. As long as the frequency of the switching is greater than
8 that which the human eye can detect, each LED 64 will appear to be on constantly when
9 the tool 10 is being operated. This frequency is controlled by the number of magnetic
10 pole pairs and the frequency at which they pass by the inductors 64. Accordingly, the
11 rotational speed of the tool 10, and the number of poles on the magnetic ring 74 controls
12 the frequency. In the preferred configuration, the positioning of the inductors 64 at
13 approximately 90 degrees relative to each other causes the current induced in each
14 inductor 64 to complement the other and therefore generate a higher current than would
15 be generated with a single inductor. As is known to those skilled in the art, the greater
16 the number of poles, the shorter the flux lines are that emanate from the magnet 74. The
17 use of eight poles for the magnet 74 therefore requires that the magnet be close to the
18 inductors 64 as shown in FIG. 6.

19 While various embodiments of the present invention have been shown and
20 described, it should be understood that other modifications, substitutions and alternatives
21 are apparent to one of ordinary skill in the art. Such modifications, substitutions and
22 alternatives can be made without departing from the spirit and scope of the invention,
23 which should be determined from the appended claims.

24 Various features of the invention are set forth in the appended claims.